

Automotive P-Channel 40 V (D-S) 175 °C MOSFET

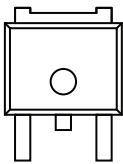
 AUTOMOTIVE
GRADE

RoHS
COMPLIANT
HALOGEN
FREE

PRODUCT SUMMARY	
V_{DS} (V)	- 40
$R_{DS(on)}$ (Ω) at $V_{GS} = -10$ V	0.0094
$R_{DS(on)}$ (Ω) at $V_{GS} = -4.5$ V	0.0190
I_D (A)	- 50
Configuration	Single

FEATURES

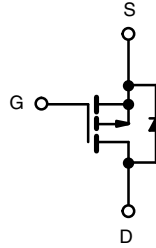
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET® Power MOSFET
- Package with Low Thermal Resistance
- 100 % R_g and UIS Tested
- Compliant to RoHS Directive 2002/95/EC
- AEC-Q101 Qualified^d

TO-252


G D S

Top View

Drain Connected to Tab



P-Channel MOSFET

ORDERING INFORMATION	
Package	TO-252
Lead (Pb)-free and Halogen-free	SQD50P04-09L-GE3

ABSOLUTE MAXIMUM RATINGS ($T_C = 25$ °C, unless otherwise noted)				
PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-Source Voltage	V_{DS}	- 40	V	
Gate-Source Voltage	V_{GS}	± 20		
Continuous Drain Current ^a	I_D	$T_C = 25$ °C	- 50	A
		$T_C = 125$ °C	- 50	
Continuous Source Current (Diode Conduction) ^a	I_S	- 50		
Pulsed Drain Current ^b	I_{DM}	- 200		
Single Pulse Avalanche Current	I_{AS}	- 50		
Single Pulse Avalanche Energy	E_{AS}	125	mJ	
Maximum Power Dissipation ^b	P_D	$T_C = 25$ °C	136	W
		$T_C = 125$ °C	45	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to + 175	°C	

THERMAL RESISTANCE RATINGS			
PARAMETER	SYMBOL	LIMIT	UNIT
Junction-to-Ambient	R_{thJA}	50	°C/W
Junction-to-Case (Drain)	R_{thJC}	1.1	

Notes

- Package limited.
- Pulse test; pulse width ≤ 300 μ s, duty cycle ≤ 2 %.
- When mounted on 1" square PCB (FR-4 material).
- Parametric verification ongoing.



SPECIFICATIONS (T _C = 25 °C, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = - 250 μA		- 40	-	-	V
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = - 250 μA		- 1.5	-	- 2.5	
Gate-Source Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 20 V		-	-	± 100	nA
Zero Gate Voltage Drain Current	I _{DSS}	V _{GS} = 0 V	V _{DS} = - 40 V	-	-	- 1	μA
		V _{GS} = 0 V	V _{DS} = - 40 V, T _J = 125 °C	-	-	- 50	
		V _{GS} = 0 V	V _{DS} = - 40 V, T _J = 175 °C	-	-	- 150	
On-State Drain Current ^a	I _{D(on)}	V _{GS} = - 10 V	V _{DS} ≤ - 5 V	- 50	-	-	A
Drain-Source On-State Resistance ^a	R _{DS(on)}	V _{GS} = - 10 V	I _D = - 17 A	-	0.0076	0.0094	Ω
		V _{GS} = - 10 V	I _D = - 50 A, T _J = 125 °C	-	-	0.014	
		V _{GS} = - 10 V	I _D = - 50 A, T _J = 175 °C	-	-	0.017	
		V _{GS} = - 4.5 V	I _D = - 14 A	-	0.012	0.019	
Forward Transconductance ^b	g _{fs}	V _{DS} = - 15 V, I _D = - 17 A		-	46	-	S
Dynamic^b							
Input Capacitance	C _{iss}	V _{GS} = 0 V	V _{DS} = - 20 V, f = 1 MHz	-	5339	6675	pF
Output Capacitance	C _{oss}			-	852	1065	
Reverse Transfer Capacitance	C _{rss}			-	681	855	
Total Gate Charge ^c	Q _g	V _{GS} = - 10 V	V _{DS} = - 20 V, I _D = - 50 A	-	103	155	nC
Gate-Source Charge ^c	Q _{gs}			-	24	-	
Gate-Drain Charge ^c	Q _{gd}			-	16	-	
Gate Resistance	R _g	f = 1 MHz		1.4	2.8	4.2	Ω
Turn-On Delay Time ^c	t _{d(on)}	V _{DD} = - 20 V, R _L = 0.4 Ω I _D ≅ - 50 A, V _{GEN} = - 10 V, R _g = 1 Ω		-	13	20	ns
Rise Time ^c	t _r			-	15	23	
Turn-Off Delay Time ^c	t _{d(off)}			-	61	92	
Fall Time ^c	t _f			-	19	29	
Source-Drain Diode Ratings and Characteristics^b							
Pulsed Current ^a	I _{SM}			-	-	- 200	A
Forward Voltage	V _{SD}	I _F = - 50 A, V _{GS} = 0 V		-	- 0.95	- 1.5	V

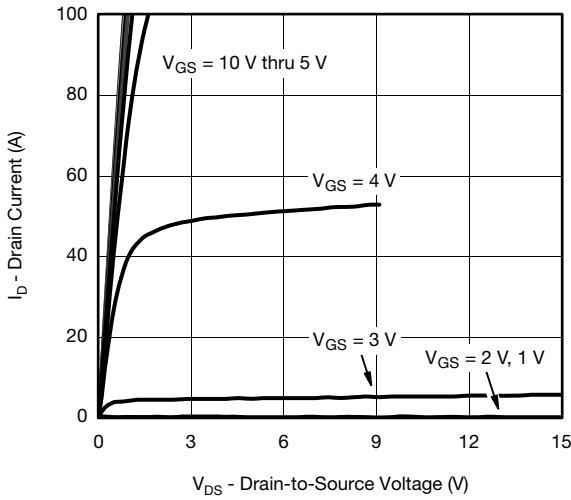
Notes

- a. Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2 %.
- b. Guaranteed by design, not subject to production testing.
- c. Independent of operating temperature.

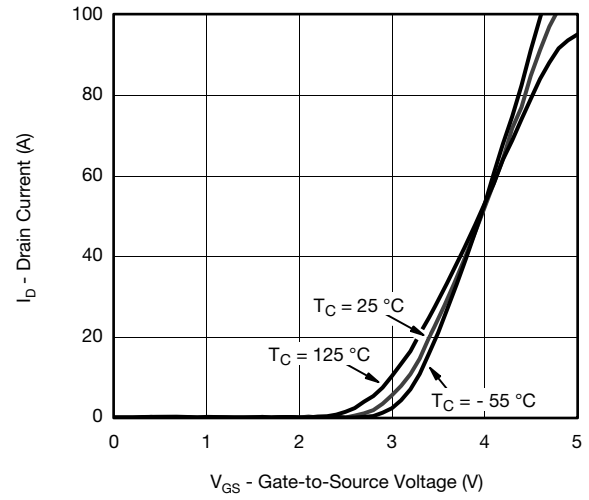
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.



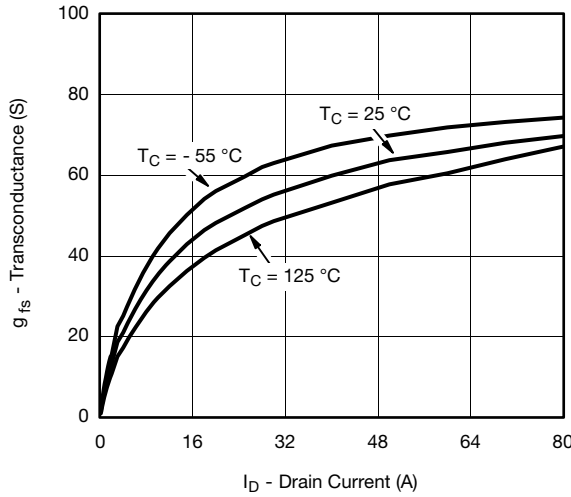
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



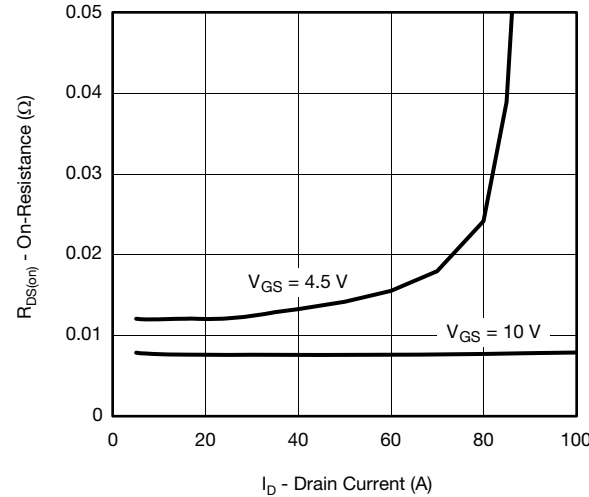
Output Characteristics



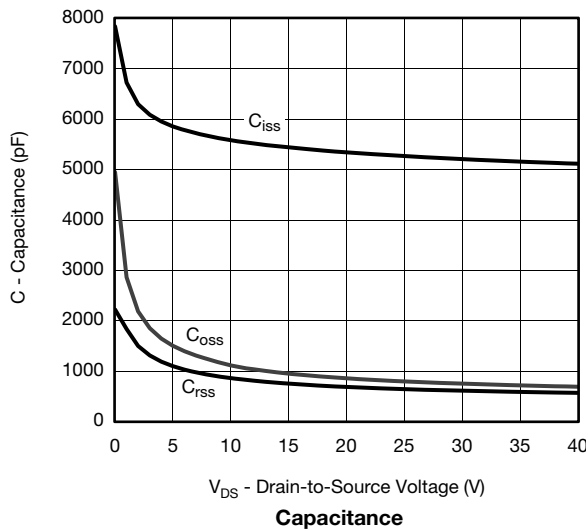
Transfer Characteristics



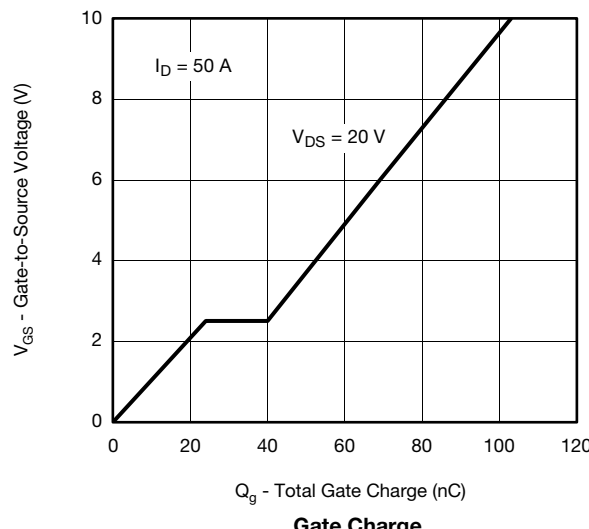
Transconductance



On-Resistance vs. Drain Current

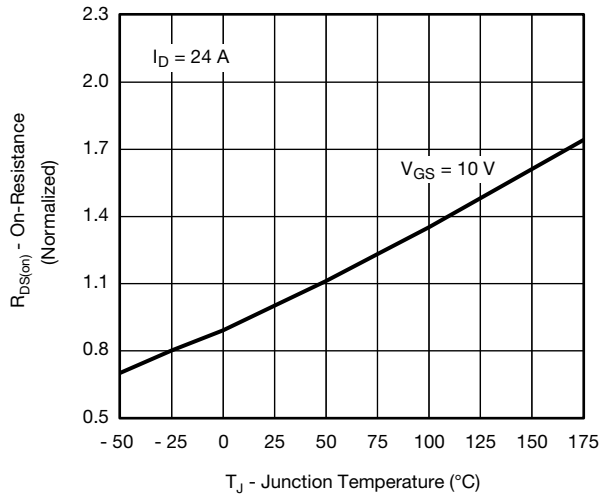


Capacitance

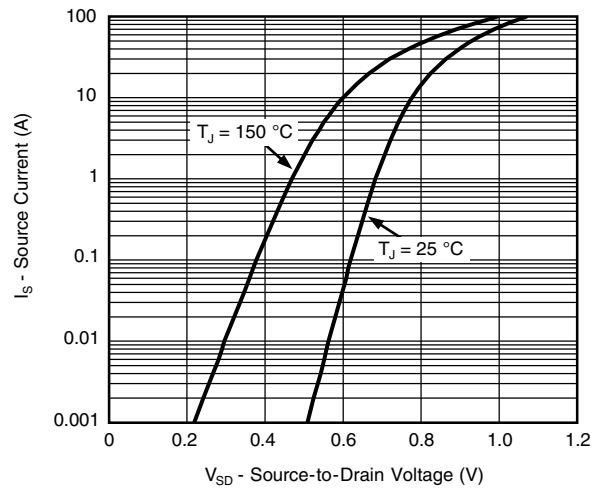


Gate Charge

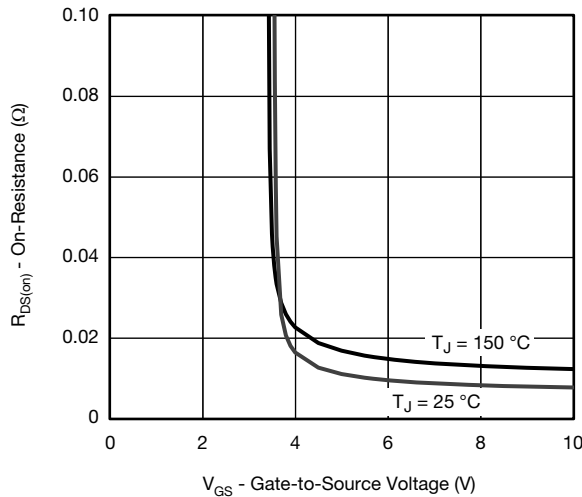
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted)



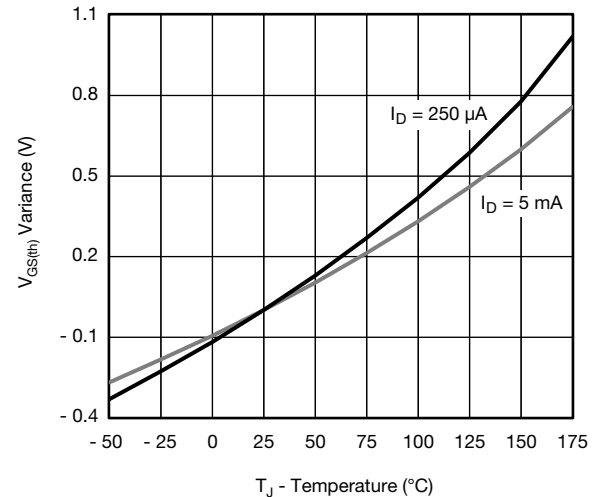
On-Resistance vs. Junction Temperature



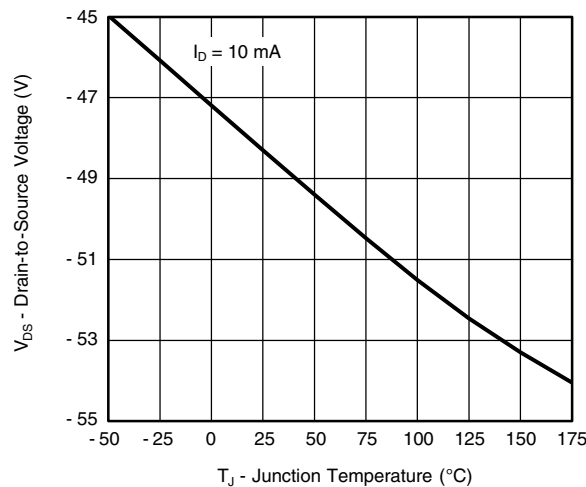
Source Drain Diode Forward Voltage



On-Resistance vs. Gate-to-Source Voltage



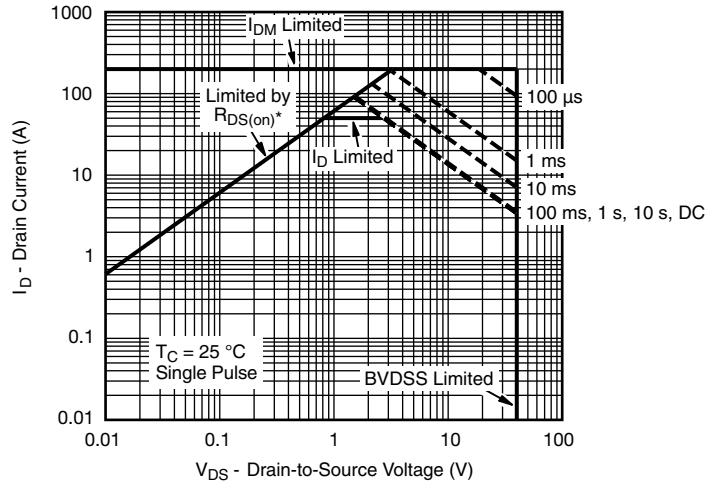
Threshold Voltage



On-Resistance vs. Junction Temperature

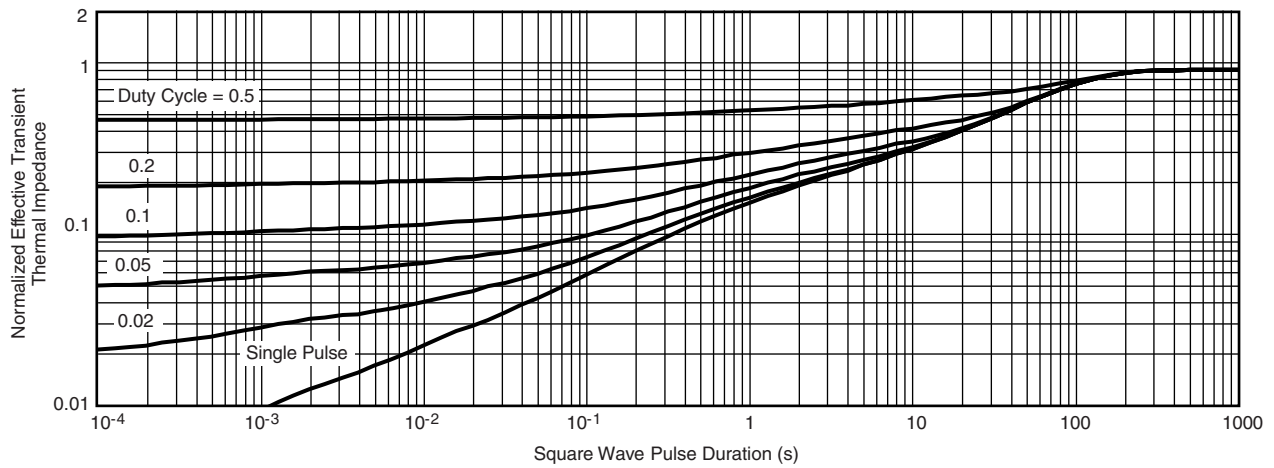


THERMAL RATINGS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted)



* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

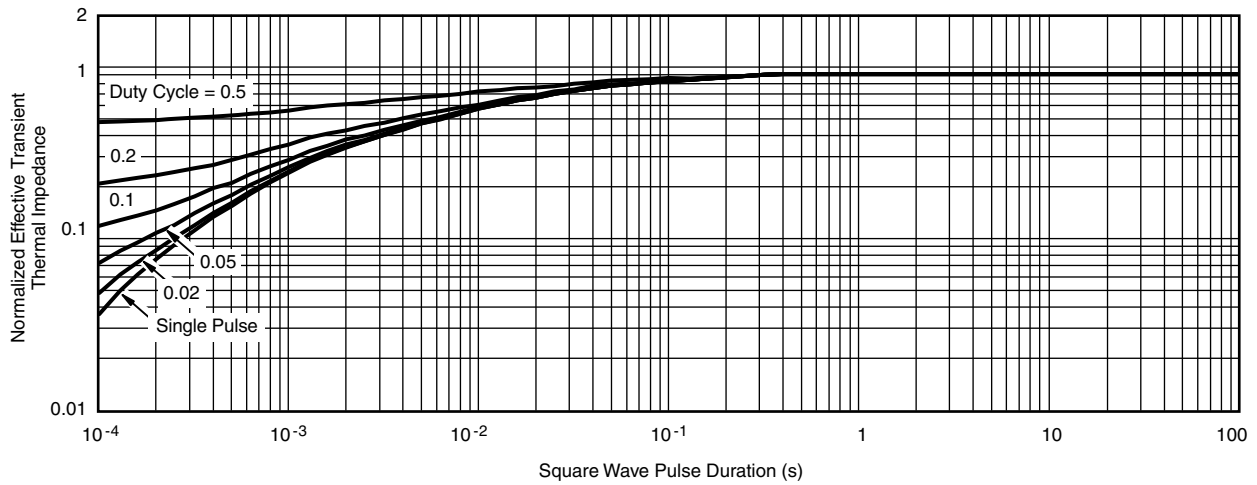
Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Ambient



THERMAL RATINGS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Case

Note

- The characteristics shown in the two graphs
 - Normalized Transient Thermal Impedance Junction-to-Ambient (25 °C)
 - Normalized Transient Thermal Impedance Junction-to-Case (25 °C)
 are given for general guidelines only to enable the user to get a “ball park” indication of part capabilities. The data are extracted from single pulse transient thermal impedance characteristics which are developed from empirical measurements. The latter is valid for the part mounted on printed circuit board - FR4, size 1" x 1" x 0.062", double sided with 2 oz. copper, 100 % on both sides. The part capabilities can widely vary depending on actual application parameters and operating conditions.

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TO-252AA Case Outline



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	2.18	2.38	0.086	0.094
A1	-	0.127	-	0.005
b	0.64	0.88	0.025	0.035
b2	0.76	1.14	0.030	0.045
b3	4.95	5.46	0.195	0.215
C	0.46	0.61	0.018	0.024
C2	0.46	0.89	0.018	0.035
D	5.97	6.22	0.235	0.245
D1	4.10	-	0.161	-
E	6.35	6.73	0.250	0.265
E1	4.32	-	0.170	-
H	9.40	10.41	0.370	0.410
e	2.28 BSC		0.090 BSC	
e1	4.56 BSC		0.180 BSC	
L	1.40	1.78	0.055	0.070
L3	0.89	1.27	0.035	0.050
L4	-	1.02	-	0.040
L5	1.01	1.52	0.040	0.060
ECN: T13-0592-Rev. A, 02-Sep-13 DWG: 6019				

Note

- Dimension L3 is for reference only.

RECOMMENDED MINIMUM PADS FOR DPAK (TO-252)



Recommended Minimum Pads
Dimensions in Inches/(mm)

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